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Aziridine-Functionalized Multiwalled Carbon Nanotubes: Robust and Versatile Catalysts for the Oxygen Reduction Reaction and Knoevenagel Condensation

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Abstract

© 2016 American Chemical Society.This paper describes the exohedral N-decoration of multiwalled carbon nanotubes (MWCNTs) with NH-aziridine groups via [2 + 1] cycloaddition of a tert-butyl-oxycarbonyl nitrene followed by controlled thermal decomposition of the cyclization product. The chemical grafting with N-containing groups deeply modifies the properties of the starting MWCNTs, generating new surface microenvironments with specific base (Brønsted) and electronic properties. Both of these features translate into a highly versatile single-phase heterogeneous catalyst (MW@NAz) with remarkable chemical and electrochemical performance. Its surface base character promotes the Knoevenagel condensation with activity superior to that of related state of the art N-doped and N-decorated carbon nanomaterials; the N-induced electronic surface redistribution drives the generation of high-energy surface "C" sites suitable for O2 activation and its subsequent electrochemical reduction (ORR).

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Keywords

chemical functionalization, electrocatalysis, Knoevenagel condensation, multiwalled carbon nanotubes, N-decoration, oxygen reduction reaction